BEAM MONITORS FOR POLARIZED BEAM

Zenei IGARASHI, Yoshiharu MORI, Sadayoshi FUKUMOTO and Yoshihisa WAKUTA*

KEK, National Laboratoy for High Energy Physics
* Kyushu University

Introduction

The project to accelerate polarized protons in the KEK 12 GeV PS is in progress now. The polarized ion source, the 750 keV CW preaccelerator, and the 750 keV beam line to the 20 MeV linac are under construction.

Because polarized beam current is very low, highly sensitive monitors must be constructed. In this paper, the current monitor, the profile monitor and the polarimeter for the 750 keV beam line, and the polarimeter for the 20 MeV beam line are described.

Current Monitor

The toroidal transformer consists of Senpermax core (TOKIN Co. Ltd.) wound with a 200 turn coil and is encased in a low carbon steel shield for noise rejection and avoiding self oscillations. In addition, the transformer is set in the atmosphere by use of ceramic beam duct for a high vacuum, easy maintenance and having no mechanical contacts with beam duct to avoid noise from mechanical impacts or vibrations.

The amplifier consists of three operational amplifiers in series. A low noise amplifier is used for the first stage.

The transformer and the amplifier are shown in Fig. 1 and the characteristics of the current monitor in Table 1.

Profile Monitor[1)]

Fig. 2 shows the motor driver with monitor head and the electronics for signal processing and local control. The monitor head consists of an array of 32 horizontal and 32 vertical beryllium-copper of 50 μm diameter wires mounted on both sides of a ceramic frame. The spacing is 2 mm.

The electronics consists of eight a 8-channel S/H circuits with high gain amplifiers, a 64 channel multiplexer, and control unit. All these circuits are installed in a NIM bin. The design specifications of the electronics are shown in Table 2.

After the S/H circuits, the signals are sent sequentially to the camac system at the C.P.U. Then the profile data are sent to the local control area by optical fiber for graphic display.

Polarimeter[2)]

The polarization is measured from the asymmetry of left and right scattered particles by the target. For the 750 keV polarimeter, Li^6 is used for the target and emitted α particles are detected. C^{12} (carbon fiber) is used for the 20 MeV polarimeter and elastically scattered protons are detected. For both polarimeters, SSD's (Solid State Detectors) are used. The preliminary test for both polarimeters will be made with an unpolarized proton beam in the near future.

References

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2) G. Ohlsen, "Techniques of Polarization Measurement-A Survey", Int. Symp. on Polarization Phenomena of Nucleons. 1975, pp.287 — 305.

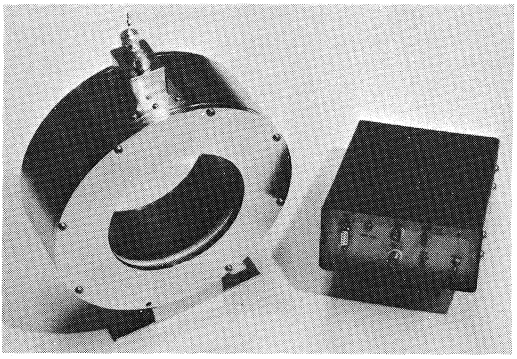

Fig.1. Current Monitor

Beam current range	: 0---55 μA
Resolution	: 0.3 μA
Frequency range	: 53 Hz-- --23 kHz
Noise level	
(higher components)	: 50 mVpp
(AC line ripple)	: 0.3 Vpp

Table.1. Electrical characteristics of Current Monitor

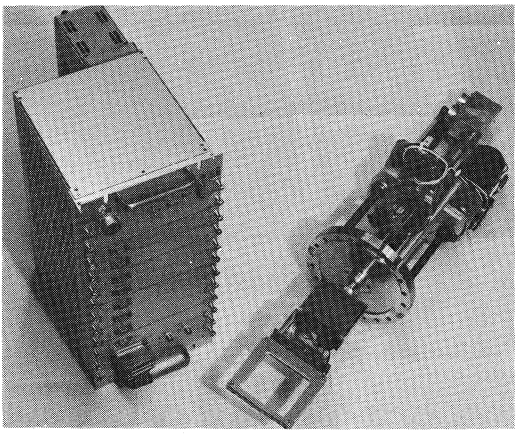

Fig.2. Profile Monitor

Input current range (from wire on monitor head)	: 0---50 nA
Resolution	: 2 nA
Frequency range	: 16 Hz-- --29 kHz
Noise level	: 0.1 Vpp

Table.2. Design specifications of the Profile Monitor electronics